

# ANOMALAGRION HASTATUM (SAY), AN AMERICAN DAMSELFLY INDIGENOUS TO THE AZORES (ODONATA, COENAGRIONIDAE)

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*Anomalagrion hastatum* (Say), a species hitherto known only from the New World, is recorded from the European archipelago of the Azores. It was captured for the first time on these islands in 1938, but was mistaken for *Ischnura senegalensis* (Rambur). Only females have been found up to now, and it is hypothesized, that this species reproduces parthenogenetically.

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In 1940 Valle published a paper on the Odonata of the Azores and Madeira, in which the occurrence of *Ischnura senegalensis* (Rambur) was reported for both the Azores and the Canary Islands. Belle (1982) examined the specimens in question from the Azores. He found that they were characterized by a very small vulvar spine and he expressed his doubts on the correctness of the identification, since the vulvar spine of *I. senegalensis* characteristically is very long (figs. 12, 15). His observations on the Canary Islands only revealed *Ischnura sabarensis* Aguesse, 1958. Hämäläinen (1986) could confirm Belle's supposition that Valle's identification for the individuals from the Canary Islands was incorrect. All specimens belonged, indeed, to *Ischnura sabarensis*.

The identity of the specimens of the Azores, however, remained uncertain due to the fact that only females were available. In the summer of 1988, the senior author decided to visit the Azores himself in order to trace the male of the misdetermined *Ischnura* species. He visited the Isles of São Miguel, São Jorge and Pico. On São Miguel and São Jorge, the desired species was not found, but on Pico more than 30 females were captured. Despite diligent hunting, the matching male was not encountered.

To unravel the status of the collected females, they then were handed over to the junior author for examination. After consultation of literature and the collection of the National Museum of Natural History, Leiden (RNHL), it soon became obvious, that they did not belong to one of the *Ischnura* species known from Europe or North Africa. They were referable to the closely related New World

genus *Anomalagrion*, and identified as *Anomalagrion hastatum* (Say). This identification was also shared by Drs. R. W. Garrison (Azusa, USA) and T. W. Donnelly (Binghamton, USA), who in collaboration examined three of the females.

## *Anomalagrion hastatum* (Say, 1839)

(Figs. 1-6, 11)

## Selected references

*Agrion hastata* Say, 1839: 38-39.

*Ischnura* (*Anomalagrion*) *hastatum*. – Selys 1876: sep. 11-13.

*Anomalagrion hastatum*. – Calvert 1901-1908: 130-131, 390; Garman 1927: 39-40, figs. 9-10, plate 2 (7); Walker 1953: 275-278, plate 11 (4), 21 (4), 26 (10), 30 (7).

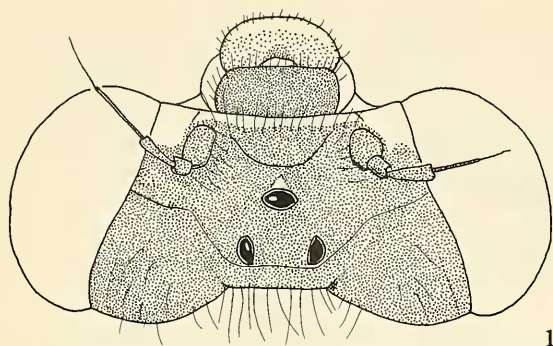
*Ischnura senegalensis* Rambur sensu Valle 1940: 2, 4 [misidentification].

## Material

Azores. Pico: Lagoa do Caiado, 23 July 1988, 13 females; 26 July 1988, 12 females; Lagoa do Capitão, 24 July 1988, 7 females (J. Belle) in RNHL, but 3 specimens in coll. Garrison and one specimen in the collection of the University of Ghent. – Other material examined (all in RNHL): USA (Indiana, Texas, Georgia), Suriname, Galapagos Islands. Also the specimens mentioned by Valle (1940) have been examined.

## Description

As indicated above, only females were collected. The material is remarkable homogeneous for a variable species as *Anomalagrion hastatum* appears to be in America. Although the specimens are relatively large for this species, they are very small for



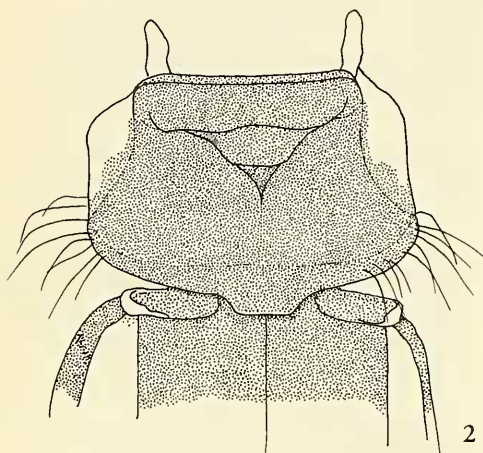
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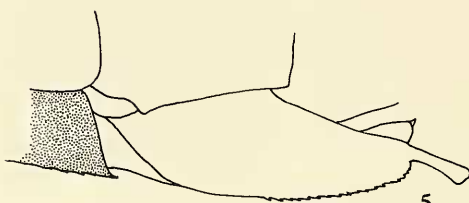
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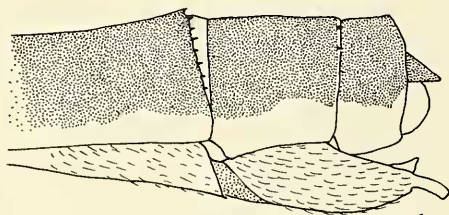
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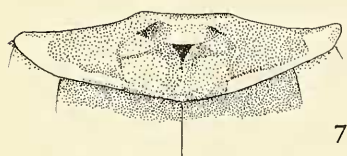
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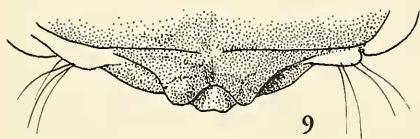
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an European damselfly. They fall within the range of the smallest European species, *Nehalennia speciosa* (Charpentier). All specimens seem to be mature.

Head (fig. 1). – Labium creamish white, labrum light brown, medio-basally with a brownish black, triangular depression (not present in specimens from the New World, available in the RNHL collection); anteclypeus creamish white, postclypeus shiny black; frons and genae yellowish white; dorsum of head dull black, the posterior spots not or only just discernable, but hind margin of occiput bordered with a pale stripe, connecting the pale areas of the rear side of the head. Head covered with fragile, pale setae.

Thorax. – Prothorax (fig. 2) predominantly dull black, but sides yellowish white; hind margin simply built with a rectangular median projection. Synthorax with dorsal side black, but otherwise light brown and creamish. Humeral suture indicated in black. Mesostigmal laminae simply built (fig. 3) with a posterior ridge, rounded on lateral side. Lateral one-fourth of mesostigmal laminae pale coloured. Legs rather short, creamish white, but outside of all femora black, and basal two-thirds of fore tibiae with a black stripe. Wings rather short, in rest approximately reaching the hind margin of segment 6; latero-posterior side of pterostigma (fig. 4) rounded with the two crossveins behind it very close to each other.

Abdomen. – Dorsum of all segments rather dull black with some bluish of greenish shine and not interrupted on any segment, nor any trace of blue coloration, as e. g. in *Ischnura sabarensis*. Posterior part of segment 10 not conspicuously raised. Vulvar spine very small, hind margin of sternite 8 not elongated or otherwise produced posteriad (figs. 5-6).

#### COMPARISON WITH EUROPEAN SPECIES OF ISCHNURA

At least three palaearctic species of the genus *Ischnura* have to be considered for the archipelago, viz. *I. pumilio* (Charpentier), *I. senegalensis* and *Ischnura sabarensis* Aguesse. The first species is widespread in Europe, and not uncommon on the Azores (Valle 1940, observations by J. Belle), the second one was recorded from the Azores (Valle 1940) and from the Canary Islands (Valle 1955). However, all specimens of *Ischnura senegalensis*

recorded from the Canary Islands appeared to belong to *I. sabarensis* (Belle 1982, Hämäläinen 1986). We also found that specimens from the Azores identified as *I. senegalensis* by Valle evidently belonged to another taxon. Apart from these species already recorded from the atlantic islands, also the other species of *Ischnura* known from northern Africa and southern Europe, have to be taken into account, viz. *I. graellsii* (Rambur), a common species on the Iberian peninsula, *I. fountainei* Morton, a species known from northern Africa and the Middle East, and less likely also *I. elegans* (Vander Linden), the most common European species and *I. genei* (Rambur), known from Corsica, Sardinia, Sicilia and Malta.

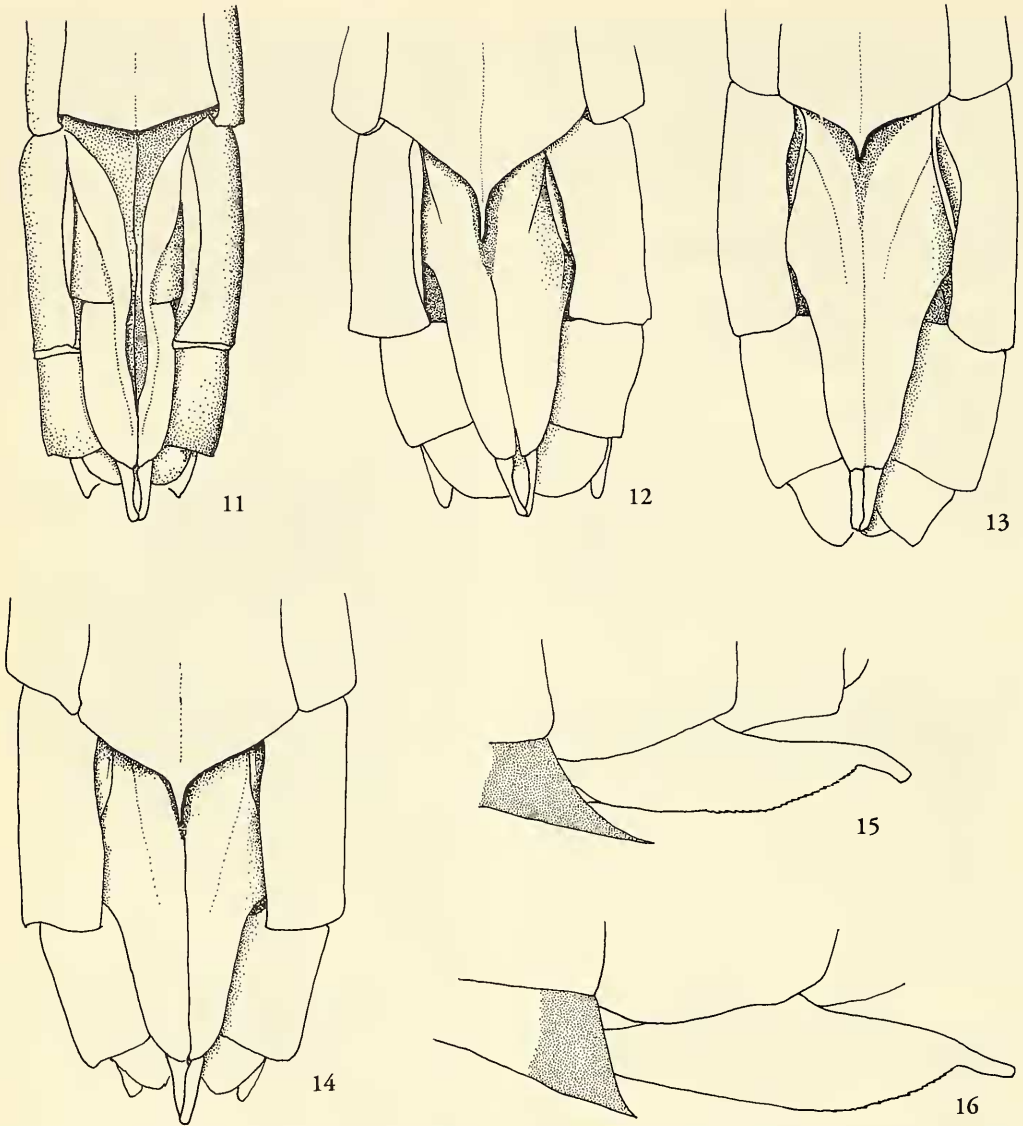
Reliable characters for distinguishing females of *Ischnura* and related genera are found in the shape of the hind margin of the prothorax (figs. 8-10), the mesostigmal laminae (fig. 7), and the vulvar spine (figs. 11-16). In many species identification is hampered by the presence of two female forms, one similar to the male (homeomorphic) and one quite dissimilar (heteromorphic) form. This phenomenon was extensively described by Schmidt (1967).

The hind margin of the prothorax of *Ischnura* species is provided with two transversal ridges, which are developed in various ways in the European *Ischnura* species. *Ischnura senegalensis* males (and the homeomorphic females) have two subequal, parallel, unconnected ridges. Although this character is unique to *I. senegalensis*, it is somewhat confusing that the heteromorphic females are more like the species of the *I. elegans* group. The females pertaining to the *I. elegans* group (with *I. elegans*, *I. genei*, *I. graellsii* and *I. sabarensis*) can be recognized by the conformation of the raised hind margin of the prothorax having a longer or shorter anterior ridge developed into a protuberance. The raised part of the posterior ridge is most luxuriantly developed in *I. genei*, which also has a more or less incised protuberance on the anterior ridge (fig. 8). The protuberance is longer and the posterior ridge shorter in *I. elegans*, so that the protuberance of the anterior ridge almost fully covers the upraised part of the posterior ridge. The hind margin of the protuberance is usually more or less squarish (e.g. Geijskes & Van Tol 1983, fig. 121, Askew 1988, fig. 138), but female specimens from southern France tend to have a more incised hind margin of the protuberance. Although the ground plan of the prothorax of *I. sabarensis* is similar to that of *I. elegans*, the protuberance of the anterior ridge is hardly developed and the whole appearance is determined by the upraised hind margin of the posterior ridge (cf. Aguesse 1958, fig. 3).

The hind margin of the prothorax of females of *Anomalagrion* is quite dissimilar, since it is simply built without subparallel ridges. The males of *A.*

Figs. 1-10. – 1, *Anomalagrion bastatum* (Say), female from Pico, head, dorsal; 2, idem, prothorax, dorsal; 3, idem, laminae mesostigmalis; 4, idem, pterostigma; 5-6, idem, end of abdomen, left profile; 7, *Ischnura senegalensis* (Rambur), female from W. Java, laminae mesostigmalis; 8, Hind margin of prothorax of female, *Ischnura genei* (Rambur) from Sicilia; 9, idem, *I. pumilio* (Charpentier) from Pico; 10, idem, *I. sabarensis* Aguesse from Algeria.





Figs. 11-16. – Abdomen of females in ventral (figs. 11-14) and left lateral (figs 15-16) view. – 11, *Anomalagrion bastatum* (Say) from Pico; 12, 15, *Ischnura senegalensis* from W. Java; 13, *Ischnura pumilio* (Charpentier) from the Azores; 14, *Ischnura graellsii* (Rambur) from Spain, Cádiz; 16, *Ischnura sabarensis* Aguesse from Gran Canaria.

*bastatum* are absolutely unmistakable, since they are characterized by a pterostigma in the forewing that is retracted from the anterior margin of the wing. They also have a greatly enlarged cylindrical bifid process on the tergum of segment 10, but that character occurs in a less conspicuous form also in some North-American *Ischnura* species. The females of *A. bastatum* also differ in several characters from *Ischnura* species. The differential features were already described by de Selys (1876)... 'The females are more difficult to identify, since they have a normal pterostigma. They are, however,

quite easily distinguishable by the coloration of the head and the thorax, which are both similar to that in the male, by the spine of segment 8, which is much shorter than those in *Ischnura*, and, finally, on segments 8 and 9, which are black (which is exceptional in *Ischnura*)....' He also mentions the existence of an orange coloured variety, which is the immature stage (Calvert 1907: 390).

Recently, a second species in the (sub)genus *Anomalagrion* was described (De Marmels 1987). Although the pterostigma of the male forewing of this species is greatly enlarged, it is not retracted

from the anterior margin of the wing. Attribution to the (sub)genus *Anomalagrion* should therefore be considered preliminary, awaiting a revision and phylogenetic analysis of *Ischnura* and related genera. Given the autapomorphies of *Anomalagrion bastatum*, a more than superficial analysis is needed to settle its position in the Coenagrionidae.

# BIOLOGICAL OBSERVATIONS

It is most remarkable that no males were collected on the Azores up to now. The senior author spent in three days collecting many hours in the field without any result. We now hypothesize, that *Anomalagrion* is, at least on the Azores, a parthenogenetically reproducing species.

Several other characters support this hypothesis. Firstly, the morphology of the specimens of the Azores is very equal, while the specimens from localities wide apart in North and South America are quite dissimilar. This phenomenon can be understood for species with (partly) parthenogenetic reproduction, where there is no or hardly any gene-flow between populations, and specimens on one locality are the offspring of only one female. Secondly, it seems that in North America *Anomalagrion bastatum* is a species frequenting temporary or recently established habitats with females much more common than males. It is obvious that fully or partially parthenogenetic reproduction is advantageous to species of this kind of habitat, while also the likelihood to produce offspring after incidental transport by air to a remote island is significantly enlarged. Further biological studies are needed to test our hypothesis. As far as we know, there is no earlier record of parthenogenetic reproduction in Odonata.

The occurrence of an American dragonfly species on the Azores is consistent with the composition of the avifauna of these islands. There is a remarkably high percentage of American bird species among the migrant visitors. Den Hartog & Lavaleye (1981), for instance, could recognize four American species among the 23 species of non-breeding birds seen during a six weeks stay on six islands of the Azores (cf. Bannerman & Bannerman 1966).

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# REFERENCES

- Aguesse, P., 1958. Une sous-espèce nouvelle d'*Ischnura* en Afrique du Nord. – Revue française d'Entomologie 25: 149-157, figs. 1-5, map 1, tabs. 1-2.
- Askew, R. R., 1988. The dragonflies of Europe. – Harley Books, Colchester: 1-291, figs. 1-502, plates 1-29.
- Bannerman, D. A. & W. M. Bannerman, 1966. Birds of the Atlantic Islands. Volume 3. A history of the birds of the Azores. – Oliver & Boyd, London: i-xx + 1-262.
- Belle, J., 1982. Odonata collected in the Canary Islands. – Entomologische Berichten, Amsterdam 42: 75-77.
- Calvert, P. P., 1901-1908. Insecta. Neuroptera. Odonata. – Biologia Centrali Americana: i-xxx + 17-420 + plates 2-10.
- De Marmels, J., 1987. *Ischnura (Anomalagrion) cruzi* sp. n., eine neue Kleinlibelle aus Kolumbien (Odonata: Coenagrionidae). – Mitteilungen der Entomologischen Gesellschaft Basel (N. F.) 37: 1-6, figs. 1-13.
- Garman, P., 1927. Guide to the insects of Connecticut. Part V. The Odonata or dragonflies of Connecticut. – Bulletin of the State Geological and Natural History Survey, State of Connecticut 39: 1-331, figs. 1-67, plates 1-22 excl.
- Geijskes, D. C. & J. van Tol, 1983. De libellen van Nederland (Odonata). – Koninklijke Nederlandse Natuurhistorische Vereniging, Hoogwoud: 1-368, figs. 1-539.
- Hartog, J. C. den & M. S. S. Lavaleye, 1981. Birds observations in the Azores (12 September-1 November 1979). – Bocagiana 56: 1-19 + plates 1-8, tabs. 1-2.
- Hämäläinen, M., 1986. Note on misidentification of the first Zygoptera material from the Canary Islands. – Notulae Odonatologicae 2: 131-132.
- Peters, G., 1988. Libellen (Odonaten) von den Kanarischen Inseln. – Entomologische Nachrichten und Berichte 32: 39-40.
- Say, T., 1839. Descriptions of new North American neuropterous insects, and observations on some already described. – Journal of the Academy of Natural Sciences of Philadelphia 8: 9-46.
- Schmidt, E., 1967. Versuch einer Analyse der *Ischnura elegans*-Gruppe (Odonata, Zygoptera). – Entomologisk Tidskrift 88: 188-225, figs. 1-2, tabs. 1-5, plates 1-7, 1 map.
- Selys Longchamps, E. de, 1876. Synopsis des Agrionines, 5me légion: *Agrion* (suite). Le genre *Agrion*. – Bulletin de l'Académie royale de Belgique (series 2) 41/42: sep. 1-282.
- Valle, K. J., 1940. Odonaten von den Azoren und Madeira. – Commentationes Biologicae 8 (5): 1-7.
- Valle, K. J., 1955. Zygopteren (Odonata) von den Kanarischen Inseln. – Annales Zoologici Fennici 21: 182.
- Walker, E. M., 1953. The Odonata of Canada and Alaska. Volume 1. – University of Toronto Press, Toronto: i-xi + 1-292, plates 1-44.

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